

Case Report

Surgical giant cell tumour of the distal ulna managed by en bloc resection, ipsilateral fibular grafting and distal radioulnar ligament reconstruction using palmaris longus tendon: a rare case report

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ABSTRACT

Giant cell tumour of bone is a benign but locally aggressive skeletal tumour, most commonly involving the epimetaphyseal region of long bones around the knee. Involvement of the distal ulna is rare and poses a reconstructive challenge because of its relationship with the distal radioulnar joint, triangular fibrocartilage complex, ulnocarpal articulation, and surrounding tendons. We report a case of a 25 year old female who presented with a gradually progressive swelling over the right wrist for six months. Clinical examination revealed a large globular swelling over the distal ulna with painful restriction of wrist motion and intact distal neurovascular status. Radiographs showed a large expansile multiloculated lytic lesion involving the distal ulna with cortical breach. MRI demonstrated a 7.8×8.4×9.6 cm expansile heterogeneous lesion involving the epimetadiaphyseal region of the distal ulna, with extensive cortical destruction, articular extension, and displacement/encasement of adjacent tendons. Fine needle aspiration cytology showed mononuclear stromal cells with numerous osteoclast-like multinucleated giant cells, suggestive of giant cell tumour. The patient underwent en bloc resection of the distal ulna with a 2 cm healthy bony margin, followed by reconstruction using a 12 cm ipsilateral fibular graft. Distal radioulnar joint stabilization was performed using palmaris longus tendon graft based on the Adams–Berger anatomical reconstruction principle, and fixation was reinforced with Kirschner wires and a dynamic compression plate. Early follow-up at one and three months showed satisfactory wound healing, maintained limb alignment, and useful active limb positioning. This case highlights that aggressive distal ulna giant cell tumour can be managed by wide resection with fibular graft reconstruction and soft-tissue stabilization, aiming to achieve local tumour control while preserving wrist and forearm function.

Keywords: Giant cell tumour, Distal ulna, En bloc resection, Fibular graft; Distal radioulnar joint, Palmaris longus. Adams–Berger reconstruction.

INTRODUCTION

Giant cell tumour of bone is an uncommon primary skeletal tumour characterized by locally aggressive behaviour, osteolytic destruction, and a tendency for recurrence despite its generally benign histological nature.^{1,2} It usually affects skeletally mature individuals in the second to fourth decades of life and demonstrates a

predilection for the epimetaphyseal region of long bones.²⁻⁵ The common sites include the distal femur, proximal tibia, distal radius, and proximal humerus, while involvement of the distal ulna is distinctly rare.⁵⁻⁸

The distal ulna has an important biomechanical role in forearm rotation and wrist stability.¹⁰⁻¹⁴ It participates in the distal radioulnar joint, supports the triangular

fibrocartilage complex, and contributes to load transmission across the ulnar side of the wrist.^{10,13,14} Tumours involving this region may therefore compromise pronation-supination, grip strength, ulnocarpal stability, and wrist function.^{6,7} Management becomes more complex when the lesion is large, expansile, articular, or associated with cortical breach and soft-tissue extension.^{2,3}

Treatment options for giant cell tumour include extended curettage with local adjuvants, bone grafting, cementation, wide resection, and reconstruction.^{2,5,9} In relatively expendable bones such as the distal ulna, wide or en bloc resection is frequently considered for aggressive lesions, particularly when there is cortical destruction, soft-tissue extension, or articular involvement.^{3,6,8} However, resection alone may lead to painful instability, ulnar stump prominence, weakness, and impaired forearm rotation.^{6,10,12} Therefore, reconstruction and stabilization procedures may be required in selected young patients¹⁰⁻¹³

We present a rare case of giant cell tumour of the distal ulna in a young female, managed with en bloc resection, ipsilateral fibular graft reconstruction, and distal radioulnar joint stabilization using palmaris longus tendon graft based on the Adams–Berger anatomical reconstruction concept^{10,11}

CASE REPORT

A 23 year old female presented to the orthopaedic outpatient department with swelling over the right wrist for six months. The swelling was initially small and gradually progressive. It was associated with local discomfort and difficulty in wrist movement. There was no history of trauma, fever, loss of appetite, weight loss, previous surgery, recurrence, or similar swelling elsewhere in the body.

On local examination, a single globular swelling was present over the distal ulnar aspect of the right wrist and distal forearm. The swelling measured approximately 7.8×8.4×9.6 cm clinically/radiologically. The overlying skin was normal in colour and temperature, without ulceration, sinus, venous prominence, or inflammatory changes. The swelling was firm, diffusely tender, fixed to the underlying bone, and the overlying skin was pinchable. Wrist range of motion was grossly restricted because of pain and mechanical limitation. Distal neurovascular examination was normal. There was no regional lymphadenopathy or evidence of systemic illness.

Routine haematological and biochemical investigations were within normal limits. Plain chest radiograph did not reveal any pulmonary lesion. Chest screening is relevant because pulmonary metastasis, although uncommon, has been described in giant cell tumour of bone.

Plain radiographs of the right wrist and forearm showed a large expansile multiloculated lytic lesion involving the

distal ulna, extending into the epiphyseal and metaphyseal region, with cortical thinning and breach. The lesion had an expansile “soap-bubble” appearance, suggestive of an aggressive benign bone tumour. Such radiographic features are typical of giant cell tumour, especially when the lesion is epimetaphyseal, expansile, and reaches the subarticular region after skeletal maturity.



Figure 1: Preoperative clinical photograph showing a large globular swelling over the distal ulnar aspect of the right wrist and distal forearm.



Figure 2: Anteroposterior radiograph of the right wrist showing a large expansile lytic lesion involving the distal ulna.

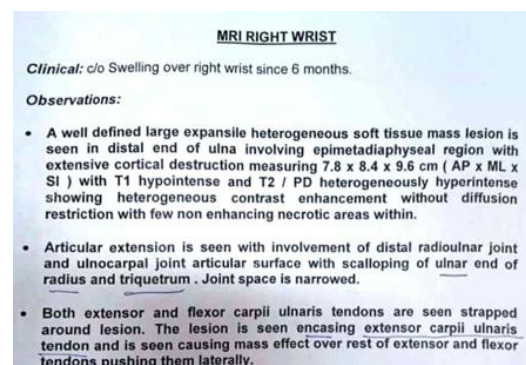


Figure 3: MRI report showing a 7.8×8.4×9.6 cm expansile heterogeneous lesion involving the epimetadiaphyseal region of the distal ulna with cortical destruction and articular extension.

MRI of the right wrist revealed a well-defined large expansile heterogeneous soft-tissue mass lesion involving the distal end of the ulna in the epimetadiaphyseal region. The lesion measured 7.8×8.4×9.6 cm in anteroposterior, mediolateral and superoinferior dimensions. It showed extensive cortical destruction, T1 hypointense signal,

T2/PD heterogeneously hyperintense signal, heterogeneous contrast enhancement, and few non-enhancing necrotic areas. There was articular extension with involvement of the distal radioulnar joint and ulnocarpal articular surface, with scalloping of the ulnar end of the radius and triquetrum. The extensor carpi ulnaris tendon was encased by the lesion, and adjacent extensor and flexor tendons were displaced laterally by mass effect. The remaining tendons, muscles and neurovascular bundle were normal. Based on clinical and radiological findings, the lesion was considered a locally invasive giant cell tumour of the distal ulna, corresponding to an aggressive Campanacci grade III lesion.

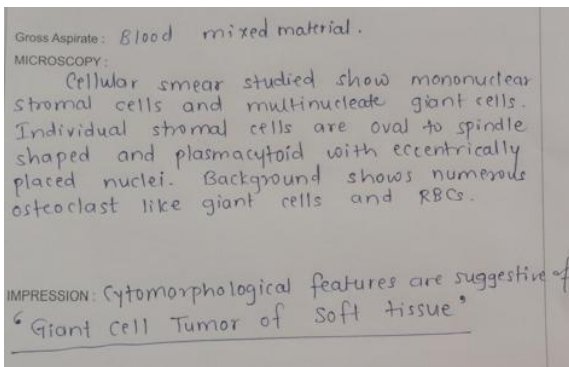


Figure 4: FNAC report showing cytomorphological features suggestive of giant cell tumour.

Fine needle aspiration cytology was performed from the lateral aspect of the right forearm swelling. The aspirate was blood-mixed. Microscopy showed cellular smears composed of mononuclear stromal cells and multinucleated giant cells. The stromal cells were oval to spindle shaped and plasmacytoid, with eccentrically placed nuclei. The background showed numerous osteoclast-like giant cells and red blood cells. Cytomorphological features were suggestive of giant cell tumour. These cytological findings were consistent with the typical cellular composition of giant cell tumour, which includes mononuclear stromal cells admixed with numerous osteoclast-like multinucleated giant cells.

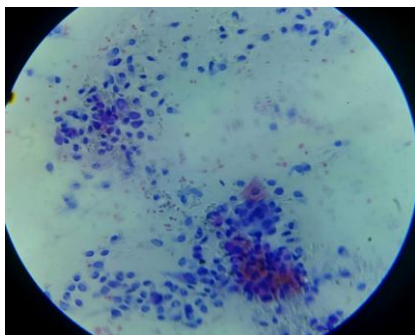


Figure 5: Cytology microphotograph showing mononuclear stromal cells with multinucleated osteoclast-like giant cells.

After clinical, radiological, and cytological evaluation, the patient was planned for surgical management. Considering

the large size of the lesion, extensive cortical destruction, articular involvement, and soft-tissue extension, en bloc resection was chosen rather than intralesional curettage. Wide resection is an accepted option in aggressive giant cell tumours where cortical breach, soft-tissue extension, and joint involvement make extended curettage less reliable for local control. Written informed consent was obtained for tumour resection, fibular grafting, tendon graft reconstruction, possible complications, recurrence risk, and use of clinical, radiological, intraoperative, cytological and follow-up images for academic publication.

Operative procedure

The patient was operated under appropriate anaesthesia with tourniquet control. Through an incision over the distal ulnar aspect of the wrist and forearm, the tumour was exposed carefully. The lesion was found to arise from the distal ulna, with expansion and thinning of the surrounding cortex. The adjacent tendons and neurovascular structures were identified and protected. The extensor carpi ulnaris tendon and surrounding soft tissues were carefully separated as far as possible from the tumour mass.



Figure 6: Intraoperative photograph showing exposure of the distal ulna tumour.



Figure 7: Harvested ipsilateral fibular graft measuring approximately 12 cm.

The ulna was drilled and osteotomized approximately 2 cm proximal to the pathological margin to ensure a healthy bony margin. En bloc resection of the distal ulna with the tumour mass and involved segment was performed. The resected specimen included the tumour-bearing distal ulna with an adequate proximal margin of healthy bone. En bloc excision has been described as a suitable option for aggressive distal ulna giant cell tumour because of the relative expendability of the distal ulna and the need for oncological clearance in advanced lesions.

An ipsilateral fibular graft of approximately 12 cm length was harvested. The graft was prepared and fashioned to reconstruct the distal ulnar defect. Drill holes were made in the fibular graft and ulnar aspect of radius anteroposteriorly, for passage of the tendon graft and stabilization.



Figure 8: Intraoperative photograph showing preparation and fixation of the fibular graft.



Figure 9: Intraoperative photograph showing plate and Kirschner wire fixation of the reconstructed segment.

The graft was positioned in the resected segment to restore ulnar-sided skeletal support and approximate distal radioulnar alignment. Reconstruction after wide resection may help preserve skeletal support, reduce painful instability, and maintain wrist alignment in young patients.

The palmaris longus tendon was harvested and used for distal radioulnar joint stabilization based on the Adams–

Berger anatomical reconstruction principle. Bone tunnels were created, and the tendon graft was passed to recreate the stabilizing effect of the distal radioulnar ligaments. The reconstruction aimed to stabilize the distal ulna/fibular graft construct and prevent painful instability during forearm rotation. The Adams–Berger technique is based on anatomical reconstruction of the volar and dorsal distal radioulnar ligaments, which are important stabilizers of the distal radioulnar joint. Biomechanical studies have also emphasized the importance of distal radioulnar ligament integrity in maintaining distal radioulnar joint stability.

The fibular graft was fixed in position using Kirschner wires and a dynamic compression plate. Intraoperative stability was checked. Haemostasis was achieved, wound closure was performed in layers, and a sterile dressing with immobilization was applied.

Postoperative management and follow-up

Postoperative radiographs of the right forearm and wrist showed satisfactory alignment of the fibular graft and stable fixation with plate and Kirschner wires.

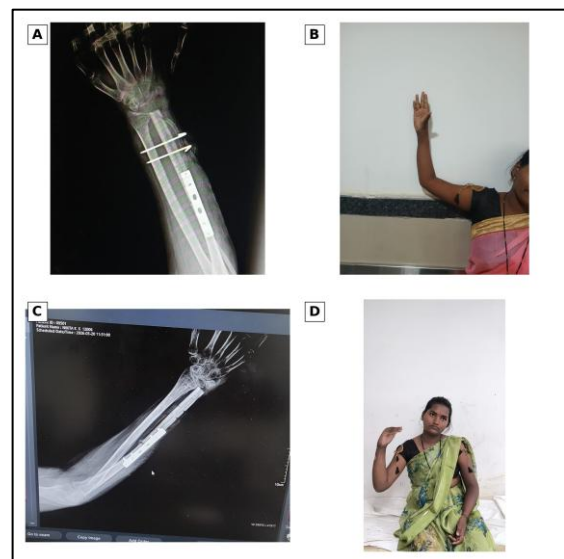


Figure 10: Postoperative follow-up composite: (A) immediate postoperative anteroposterior radiograph showing fibular graft reconstruction with plate and Kirschner wire fixation; (B) one-month postoperative clinical photograph showing early functional recovery with active limb positioning; (C) three-month postoperative anteroposterior radiograph showing fibular graft reconstruction after K-wire removal; and (D) three-month postoperative clinical photograph showing active wrist and forearm positioning.

The patient was immobilized in an above-elbow slab/cast to protect the reconstruction and graft fixation. Limb elevation, analgesics, antibiotics, and active finger mobilization were advised. The patient was monitored for wound complications, distal neurovascular status.

The resected tumour specimen was sent for histopathological examination. Histopathological confirmation is important because giant-cell-rich lesions may mimic giant cell tumour clinically, radiologically, or cytologically. Final histopathological details should be incorporated in the manuscript if available before journal submission.

At one-month postoperative follow-up, the surgical wound had healed satisfactorily and the patient was able to actively position the operated limb, with early functional recovery of the elbow, forearm and wrist. Clinical photographs at one month showed maintenance of limb alignment without obvious deformity or wound complication. K-wires were removed at this time in treatment.

At three-month postoperative follow-up, the patient demonstrated further functional recovery with active movement of the operated upper limb. Clinical photographs showed the patient performing active elbow flexion and extension positioning, wrist and hand positioning. There was no obvious clinical evidence of local recurrence or implant-related complication at this stage. Serial radiographic follow-up was advised to assess graft incorporation, implant position, wrist alignment and tumour recurrence.

Long-term follow-up is essential because giant cell tumour is known for local recurrence even after apparently adequate treatment. Continued surveillance should include clinical examination, serial wrist and forearm radiographs, assessment of forearm rotation, grip strength, wrist function, graft incorporation and chest screening when indicated.

Functional assessment

Functional outcome was assessed in terms of pain, range of motion, strength, activities of daily living, return to routine function, and patient satisfaction. Pain was evaluated using VAS/NRS. Range of motion was assessed clinically and with a goniometer, especially forearm pronation-supination and wrist movements, as distal radioulnar stability is essential for forearm rotation. Strength was assessed by Manual Muscle Testing and grip strength comparison with the opposite limb. Activities of daily living and return to routine work were noted during follow-up. Patient satisfaction was graded as excellent, good, fair, or poor. Longer follow-up is required to assess graft incorporation, functional recovery, distal radioulnar stability, and recurrence.

DISCUSSION

Giant cell tumour of bone is a benign but locally aggressive tumour composed of neoplastic mononuclear stromal cells and numerous osteoclast-like multinucleated giant cells.^{1,5} Although histologically benign in most cases, it can behave aggressively, causing cortical destruction, pathological fracture, soft-tissue extension and local

recurrence.^{2,3} Rarely, pulmonary metastasis may occur even in histologically benign lesions.^{5,15} The tumour classically occurs after physal closure and is commonly seen in young adults.^{2,4,5}

Distal ulna involvement is rare compared with the more common sites around the knee and distal radius.⁵⁻⁸ The rarity of this location makes every well-documented case clinically relevant. Distal ulna lesions may present late because the swelling may initially be painless and because the ulna is relatively subcutaneous, allowing gradual expansion before severe functional compromise develops.^{6,7} In the present case, the patient had a large swelling for six months, with restricted wrist motion but intact distal neurovascular status.

Radiographically, giant cell tumour typically appears as an eccentric, expansile, lytic lesion extending up to the subarticular bone.^{2,5} In aggressive lesions, cortical breach and soft-tissue extension may be present.^{2,3} The present case showed a large expansile multiloculated lytic lesion involving the distal ulna, with MRI demonstrating extensive cortical destruction, articular involvement, tendon encasement/displacement, and necrotic areas. These findings were consistent with an aggressive lesion. Based on Campanacci grading, cortical destruction and soft-tissue extension are features of grade III disease.²

The treatment of distal ulna giant cell tumour remains controversial because both oncological clearance and functional preservation are important.⁶⁻⁸ Intralesional curettage with local adjuvants is considered in contained lesions where joint integrity and cortical shell are preserved.^{2,5} However, in large lesions with cortical breach, soft-tissue extension, articular involvement, and marked expansion, extended curettage may carry a higher risk of recurrence and may not provide sufficient structural or oncological control.^{2,3,5} In such situations, en bloc resection is commonly preferred.⁶⁻⁸

Simple distal ulna excision may be sufficient in some cases because the distal ulna is considered relatively expendable.⁸ However, excessive resection may lead to painful ulnar stump instability, convergence of the radius and ulna, reduced grip strength, ulnar-sided wrist pain, and impaired pronation-supination.^{6,10,12} These complications are especially relevant in young patients who require durable wrist function. Therefore, reconstructive strategies have been described, including fibular grafting, ulnar stump stabilization, tendon tenodesis, radioulnar stabilization, and distal radioulnar ligament reconstruction.^{6,10-13}

In the present case, the defect after en bloc resection was reconstructed using an ipsilateral fibular graft. Fibular grafting provides a biological structural substitute, helps maintain forearm length and ulnar-sided support, and may reduce the risk of painful instability compared with excision alone.^{6,9} The graft was reinforced with a dynamic compression plate and Kirschner wires to provide stability during incorporation.

A notable feature of this case is the use of palmaris longus tendon graft for distal radioulnar stabilization using the Adams–Berger anatomical reconstruction principle.^{10,11} The Adams–Berger technique was originally described for post-traumatic distal radioulnar joint instability, with reconstruction of the volar and dorsal distal radioulnar ligaments using a tendon graft.¹⁰ In the context of tumour resection and fibular graft reconstruction, this principle can be adapted to enhance stability of the reconstructed distal ulna and reduce the risk of postoperative instability. The importance of distal radioulnar ligament reconstruction is further supported by biomechanical studies on distal radioulnar joint stability.^{13,14}

Fine needle aspiration cytology in the present case showed typical features of giant cell tumour, including mononuclear stromal cells and osteoclast-like multinucleated giant cells.^{1,5} However, FNAC should ideally be supplemented with histopathological confirmation, especially in aggressive lesions, to exclude other giant-cell-rich lesions such as aneurysmal bone cyst, chondroblastoma, brown tumour of hyperparathyroidism, giant cell reparative granuloma, telangiectatic osteosarcoma, and metastatic lesions.^{4,5}

The present case is important because of the rare location, large tumour size, aggressive radiological features, and reconstructive management. En bloc resection achieved removal of the tumour with a healthy margin, while fibular grafting and palmaris longus-based stabilization attempted to preserve wrist alignment and distal radioulnar stability. Early follow-up at one and three months showed satisfactory wound healing, maintained limb alignment, and useful active limb positioning. However, longer follow-up is required to evaluate graft incorporation, forearm rotation, grip strength, wrist function, recurrence.^{2,5,15}

CONCLUSION

Giant cell tumour of the distal ulna is a rare entity and requires individualized management. Large aggressive lesions with cortical destruction, articular involvement and soft-tissue extension may be better treated by en bloc resection rather than curettage alone. Reconstruction with ipsilateral fibular graft and distal radioulnar stabilization using palmaris longus tendon graft based on the Adams–Berger principle can provide structural support and may help preserve wrist and forearm function. In the present case, early postoperative follow-up at one and three months showed satisfactory clinical recovery with useful active limb positioning and no obvious early clinical evidence of recurrence. However, long-term follow-up is essential to monitor graft incorporation, functional outcome and local recurrence.

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